Impact of Participation in a Wellness Program on Functional Status and Falls Among Aging Adults in an Assisted Living Setting

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Summary: Aging adults residing in assisted living facilities are vulnerable to the effects of cumulative chronic illness and increasingly sedentary lifestyle, both contributing to risk of functional decline over time. Participation in regular exercise appears to preserve functional status and may minimize the rate of functional decline. This quasi-experimental study evaluated the longitudinal impact of regular participation in a wellness exercise program on functional status of residents in assisted living. Thirty-six aging adults participating in a multimodal wellness program were evaluated on enrollment and after 12 months of participation. Cognitive status (Mini-Mental State Examination score), postural control/fall risk (Berg Balance Scale score), and cardiovascular endurance/mobility (6-Minute Walk Test distance) were examined on enrollment and at annual reassessment. Falls over 12 months were determined by tracking annual reported incidence of falls. Subjects were classified as "regular" or "non regular" exercisers on the basis of participation frequency and adherence. Chi-square analysis and analysis of variance were used to screen for initial differences between groups. Repeated-measures analysis of variance evaluated differences in cognitive status, falls, and functional measures between groups at annual reassessment. Mean age (SD) of participants was 85.5 (6.3) years (range = 72-96 years). There were no differences between groups at the time of enrollment. At annual reassessment, regular exercisers demonstrated better preservation of functional status and a lower rate of falling than nonregular exercisers. Regular participation in an individualized wellness program as little as twice weekly for 9 of 12 months provides protection against functional decline and risk of falls in older adults in assisted living settings.

Problem: Aging adults residing in assisted living facilities are vulnerable to the effects of cumulative chronic illness and increasingly sedentary lifestyle, both contributing to risk of functional decline over time. Participation in regular exercise appears to preserve functional status and may minimize the rate of functional decline.

Purpose: This quasi-experimental study evaluated the longitudinal impact of regular participation in a wellness exercise program on functional status of residents in assisted living.

Methods: Thirty-six aging adults participating in a multimodal wellness program were evaluated on enrollment and after 12 months of participation. Cognitive status (Mini-Mental State Examination score), postural control/fall risk (Berg Balance Scale score), and cardiovascular endurance/mobility (6-
Minute Walk Test distance) were examined on enrollment and at annual reassessment. Falls over 12 months were determined by tracking annual reported incidence of falls. Subjects were classified as "regular" or "non regular" exercisers on the basis of participation frequency and adherence. Chi-square analysis and analysis of variance were used to screen for initial differences between groups. Repeated-measures analysis of variance evaluated differences in cognitive status, falls, and functional measures between groups at annual reassessment.

**Results:** Mean age (SD) of participants was 85.5 (6.3) years (range = 72-96 years). There were no differences between groups at the time of enrollment. At annual reassessment, regular exercisers demonstrated better preservation of functional status and a lower rate of falling than nonregular exercisers.

**Conclusion:** Regular participation in an individualized wellness program as little as twice weekly for 9 of 12 months provides protection against functional decline and risk of falls in older adults in assisted living settings.

**Introduction:** Aging adults are particularly vulnerable to declining physical function and falls; risk factors for both include sarcopenia, diminished activity levels, chronic illness, and the use of multiple medications.1-3 Fear of falling, a pervasive problem that contributes to reduced activity, is not limited only to those with history of falls.3 Concern about falling is linked to an individual's perception of one's balance ability; confidence in being able to safely participate in daily activities without falling has been linked with balance performance.4 Older adults who fall or have developed a fear of falling are at risk for progressive restriction of participation in social and physical activities, declining quality of life, early nursing home placement, and escalating balance and gait disorders, each of which has significant impact on physical function.1,5,6

Reduced physical function is no longer considered to be a natural consequence of aging and has been strongly correlated with impairment of lower extremity muscle performance.7-8 Many studies demonstrate that participation in a strengthening exercise improves balance, gait speed, and endurance as well as reduces both risk for falls and incidence of falls in older persons across all levels of residential settings.9-19 Fiatarone et al20 demonstrated that loss of muscle strength could be reversed even in the oldest old with a program of progressive resisted exercises, making it possible for the frail older adult population to reap the wealth of benefits associated with increased muscle strength.

Wellness exercise programs of many types are available to residents of independent and assisted living settings. Such programs are designed with the goals of maintaining or improving mobility and reducing the incidence of falls, thereby preserving physical function for residents. While there is widespread
agreement that regular exercise is key in improving muscle strength, balance, and walking as well as reducing the incidence of falls, whether exercise can effectively preserve or slow functional decline over time for vulnerable elders is not well understood.

Jensen et al. 21 reported that regular participation in an exercise program by frail older adults preserved independent ambulation and gait speed as compared with a nonexercise control group who experienced deterioration in these abilities over a 9-month period. There was, however, no change in balance or fall risk for the exercise group despite preservation of ambulation. Baum et al. 12 demonstrated improved physical and cognitive functions in long-term care residents participating in a group seated strengthening program, but the program’s impact on falls and walking ability was not assessed. Campbell et al. 22 reported that consistent adherence to an individually prescribed exercise program prevented falls over a 2-year period in women 80 years and older. Other measures of function were not assessed. The great success of this program was attributed to the individualized program that targeted each person’s particular limitations.

This study assessed the impact of regular participation in individualized wellness exercise programs, over the period of 1 year, on the physical function and cognitive status of older adults in an assisted living setting. The aspects of physical function tracked over time were balance, walking endurance, and incidence of falls.

**METHODS**

Description of the Wellness Program:

The university's physical therapy faculty practice was contracted by a local assisted living community to develop, implement, and evaluate outcomes of programs offered at an on-site wellness center at the assisted living facility. During the study period, there were, on average, 71 individuals residing in the facility's 68 apartments. The Wellness Center was staffed by graduate physical therapy and undergraduate exercise science students under direct supervision of the director of the Wellness Center, a licensed physical therapist. The Wellness Center staff offered small group and individual exercise sessions, with emphasis on balance/ postural control, endurance, flexibility, and strengthening. These components were targeted because of the prevalence of changes in balance, cardiovascular endurance, and muscle performance associated with aging and their impact on physical function in very old adults.7,8,14,23

Strengthening programs focused on upper and lower extremity progressive strengthening and flexibility activities performed in sitting by using free weights and resisted exercise bands. Lower extremity
progressive resisted training exercise focused on gluteal, quadriceps, and ankle dorsiflexor and plantarflexor muscles. A "beginners" balance class was designed for persons with impaired balance or a history of high risk of falls (Berg Balance Scale [BBS] score < 45A56). This group balance class focused on activities that promoted translation of center of mass within the base of support, as well as hip strengthening and ankle strengthening and flexibility, with varying degrees of upper extremity support at wall railing according to resident's need and ability. Postural control activities for this group promoted increasing sway envelope through multidirectional weight shift through pelvis, lateral walking, and multidirectional reaching. Lower extremity strengthening exercises included standing, resisted hip abduction, heel and toe raises, and mini squats. An "advanced" balance class designed for persons with mild balance limitations and low fall risk (BBS score 45/56 or more) incorporated endurance, flexibility, lower extremity strengthening, and balance activities that required controlled center-of-mass translations of varying magnitude in standing in a group circuit-training format. Participants transitioned between activities that included multidirectional reaching in wide tandem stance position, timed march in place, controlled unilateral stance with varying upper extremity positioning, resisted hip abduction and extension exercises, multidirectional and rotational ball passes, ankle strengthening and flexibility exercises, and trunk flexibility and breathing exercises. Supervised aerobic training used aerobic equipment including recumbent stepper, stationary bike, or treadmill available in the Wellness Center. Each of these pieces of equipment was designed for aging adults, with characteristics including ease of mounting/dismounting for persons with musculoskeletal or balance impairment and trajectory of motion comfortable for persons with degenerative joint disease of the lower extremities. A therapeutic exercise pool was available for an individualized progressive resisted exercise program aimed at strengthening extremity and core muscles as well as for flexibility activities. Participants could attend balance and seated strengthening classes and use the pool and aerobic equipment on a 3 times per week basis for each activity in which they were interested.

Before beginning any wellness activities, interested residents were required to undergo a function-based screening with the director of the Wellness Center to determine their chief limitations and baseline activity level. The screening included review of health status and medication use and assessment of balance (BBS), endurance (Six-Minute Walk Test [6MWT]), and cognition (Folstein Mini-Mental State Examination [MMSE]). On the basis of results of the screening, the director made recommendations about which wellness activities would be most beneficial for each individual, addressing the physical impairments and functional limitations identified on initial assessment. The specific programs that each person chose to participate were determined by his or her individual interest in conjunction with the director's recommendations. This screening was repeated annually to track changes over time.
All potential participants were required to have medical clearance from their primary care physician, were apprised of potential risks and benefits of participation in wellness activities, and were required to have a signed informed consent form before beginning the program. Records were kept of frequency of participation and types of programs each participant attended.

Study Design

The study used a quasi-experimental, longitudinal, pretestposttest design.

Exclusion Criteria

Any participant who had surgery or other unpredicted health event that impacted his or her ability to exercise or required traditional rehabilitation care during the recovery period was excluded from analysis. Those who declined annual reassessment were also excluded.

Descriptive and Performance Variables

Descriptive statistics were calculated for health status (eg, history of stroke, osteoporosis, diabetes, and various cardiac diseases), number of prescription medications used, and regular use of ambulatory assistive devices (eg, cane and standard or rolling walker). The number of falls sustained by each participant during the 12-month period was documented by review of incident reports maintained by nursing staff per the facility's required procedures. Falls were defined by the facility's nursing department as a witnessed episode of loss of balance that rendered the resident to rest on a lower surface or when they were found on the floor.

The BBS was used to assess balance and categorize risk of falling. The BBS is a 14-item performance-based measure. Each item is scored on an ordinal scale (0 = unable, 4 = safe and effective performance). BBS score is the sum of item scores; maximum possible score is 56 points. Items include assessment of static sitting and standing balance, as well as dynamic anticipatory postural control while performing components of typical daily functional activities (eg, transferring to a chair, stepping up to a step, reaching, bending).27 It demonstrated high specificity in identifying participants with no history of falls in a population of older adults 69 to 94 years of age, with a cutoff score of 45 of 56.27 Norms for performance on BBS have been reported for community living older adults 60 years and older.28,29

Functional lower extremity strength was assessed by noting performance on BBS items 1 (sitting to standing), 4 (standing to sitting), 12 (alternate stepping), 13 (tandem standing), and 14 (standing on 1 leg). The director recommended participation in strength classes if subject scored less than 3 of 4 on 1 or more of these items.
The 6MWT provided indication of overall endurance during walking. Maximum distance that an individual covered during a 6-minute period of walking at self-selected velocity is recorded. The 6MWT was originally developed to assess function and response to exercise as an alternative for treadmill exercise testing for persons with significant cardiac or pulmonary disease.30 The 6MWT has also been used to assess functional mobility and endurance in older persons, with normative values established on the basis of age and gender, and factoring weight and cognitive status.25,28,29,31,32 Recommendation for participation in aerobic training was made if subjects were unable to complete a distance of at least 1000 ft during the 6MWT, based on age-related norms for community - (community-living) adults.28,29

The MMSE was used to assess cognitive status. It is an 11-item test scored on a total of 30 points that assesses orientation, attention, registration, immediate and short-term recall, and language abilities. A score of 23 of 30 or below indicates cognitive dysfunction but does not identify the disease process underlying the cognitive changes.26 This was used to track change in cognitive function over time but did not influence recommendation about appropriate wellness programming.

Level of Participation

Of the 71 residents living in the facility during the study period, approximately 50% (n = 36) participated in the annual functional screening. At annual reassessment, 19 residents were classified as "regular" exercisers and 17 as "nonregular" exercisers on the basis of frequency and consistency of their participation in Wellness Center programs. Regular exercisers attended exercise sessions 2 or more times per week for at least 9 months of the year. Nonregular exercisers participated in wellness activities less than twice each week or had interruption of participation for more than 3 months. Nine-of 12-month criteria for regular exercisers reflected participation that was interrupted by holiday travel, winter residence in a southern state, or 4 or more consecutive weeks of being away from the facility for family events or visits. Any participant who had surgery or other unpredicted health event that impacted his or her ability to exercise or required traditional rehabilitation care during the recovery period (n = 5) was excluded from analysis. Those who declined annual reassessment (n = 30) were also excluded.

Statistical Analysis

Chi-square analysis was used to identify possible initial differences between the regular/nonregular exercise groups on nominal variables. Distributions of scores on functional and cognitive measures on enrollment were evaluated for satisfaction of parametric assumptions. One-way analysis of variance was used to identify possible initial differences on ordinal and continuous variables (age, MMSE and BBS scores, and 6MWT distance). Repeated-measures analysis of variance evaluated whether pre- and
postparticipation scores differed by group, as well as whether rate of change in functional status and of falls differed between groups.

RESULTS

Thirty-six of 71 residents initially evaluated by the physical therapist met inclusion criteria: 17 as nonregular participants and 19 as regular participants. Table 1 summarizes baseline characteristics and health status of participants. There were no initial differences between groups with respect to health history, use of ambulatory assistive device, or number of prescription medications used.

Initial scores on MMSE, BBS, and 6MWT are given in Table 2. There were no significant differences noted between groups on enrollment. Both groups were below the BBS score, indicative of fall risk, as well as below age-related norms for community-living older adults. According to Steffen et al,28 BBS scores for healthy community-dwelling adults 70 years and older average 50 to 54. Our participants' balance scores were much lower than those of their community-dwelling counterparts, with an initial mean (SD) score of 43.5 (4.8) for the nonregular exercise group and 39.9 (11.38) for the regular exercise group. Similarly, 6MWT distances for both groups were below age- and gender-related norms. Mean (SD) 6MWT distances for healthy older adults aged 70 to 79 years living in the community were 527 (85) m for men and 471 (73) m for women, whereas adult men and women aged 80 to 89 years were able to achieve distances of 417 (73) and 391 (85) m, respectively.28 The subjects in this study demonstrated comparatively much lower walking distance capacities, with the initial mean (SD) distance for the nonregular exercise group being 690.6 (287.2) ft or 210.5 (87.5) m and the regular exercise group achieving only 607.6 (322.9) ft or 185.2 (98.4) m, and greater variability within the groups. Mean MMSE scores for both groups indicated little cognitive dysfunction on initial assessment.

At the 12-month reassessment, the regular exercise group demonstrated stability or slight improvement in balance and endurance over baseline BBS and 6MWT scores, whereas the nonregular exercise group demonstrated declines in balance and endurance over baseline BBS and 6MWT scores (P = .07 and P = .11, respectively) (Table 3 and Fig 1). Both the groups demonstrated declines in MMSE scores, but the rate of decline appeared to be less for regular exercisers. The number of documented fall events during the study period was higher for nonregular exercisers than for regular exercisers.

While falls occurred in both groups, individuals in the regular exercise group were less likely to experience a fall (25%) in the time between enrollment and annual followup than nonregular exercisers (75%) (Fig 2).

DISCUSSION
Many aging adults and their adult children choose assisted living centers as a means of preserving functional independence within a safe and supportive environment. Functional decline, falls, and fall-related injuries are significant concerns for residents, their families, and staff of assisted living communities. Each of these impact on the residents' quality of life and contribute to likelihood of adverse outcomes including disability, nursing home placement, and increased cost and burden of care. The increasing recognition of the benefits of exercise for frail and vulnerable aging adults as a means to maintain or improve function and minimize the incidence of injurious falls contributes to the development and promotion of wellness exercise programs in independent and assisted residential care facilities. The results of this study add to the growing body of knowledge that not only exercise can maintain function but also regular exercise has the long-term effect on minimizing the rate of functional decline that is pervasive in the very old adult.

There are challenges in providing wellness programs with effective outcomes for residents of assisted living settings who are "aging in place" and vary greatly in terms of age, medical status, and physical abilities. While changes in cardiovascular function, muscle performance, and joint flexibility are recognized as a part of typical aging, it is the effects of chronic illness and sedentary lifestyle leading to muscle weakness, diminished endurance for activity, and balance and gait impairments that have the most profound impact on physical function. With this in mind, wellness programs likely need to take a multimodal approach to include a variety of activities addressing balance, strength, and endurance in order to effectively address the diverse needs and abilities of participating older adults. Studies that demonstrate efficacy of individualized multimodal interventions may not identify which aspect of intervention is most "important" for preserving function or reducing risk of decline. They do, however, illustrate that attention to individual needs among a population with great variation in abilities and resources can be, in the broad sense, effective in slowing or preventing such decline. This work, in contrast with the many studies that examine outcomes of a specific intervention strategy, supports the efficacy of wellness exercise programs individualized to residents' particular needs, abilities, and interests. In this study, regular participation in individualized programs appeared to have positively impacted on the rate of falling, mobility, balance, and cognitive function. Future work might investigate how such individualized multimodal interventions impact on residents' perception that their specific needs are being addressed and how this may contribute to residents' willingness to continue to participate over time.

While the literature has clearly identified the short-term benefit of regular exercise to improve muscle strength, balance, and gait and reduce the incidence of falls, less has been documented about the long-term effect of regular exercise on physical function. This study contributes to the findings of other authors who elucidated the impact of exercise on preserving or maintaining physical functional
status in the aging-in-place community. It has done so by considering functional performance and
cognition rather than by absolute change in muscle performance.

Limitations

The study has limitations that must be considered when interpreting findings. The quasi-experimental
design, with no control group of nonexercisers, places the level of evidence provided by this work on the
lower end of the Sackett classification.40 The small sample size coupled with intraindividual variability in
physical ability and medical comorbidities inherent among older adults in assisted living settings must
also be considered. Both small sample size and within-group variability can negatively influence
achievement of statistical significance for intervention outcomes. The mean scores for the exercise and
nonexercise groups were similar at baseline, with moderate within-group variability. While
postintervention differences between the regular and nonregular exercise groups may not have been
statistically significant, the difference in scores suggests clinical relevance, given small sample size.
Future studies with more subjects would better illuminate the relationship between regular
participation in exercise and preservation of function.

Although walking endurance was assessed through a validated measure of fitness and endurance of
older adults, gait speed was not measured. Gait speed is a strong correlate of function and predictor for
future hospitalization and mortality.41,42 Further studies on the long-term impact of exercise by using
gait speed as a indicator of physical function would provide a valuable addition to the current body of
knowledge.

A single measure of balance was used to determine functional balance and fall risk. The BBS is highly
specific in identifying people who are not likely to fall but has been found to have only 64% sensitivity
for identifying people at risk for falls.27,43 The use of additional validated measures of balance and risk
of falls should be considered for future studies.

This study did not seek to differentiate which intervention had the greatest impact on physical function.
Although recommendations for participation in particular types of exercise were provided, subjects self-
selected the programs they attended and may have been involved in 1 or more of the programs offered.
In this supervised setting, the intensity of each subjects’ activity level was progressed on a regular basis
because they found the activity reportedly to be easy to perform, promoting ongoing improvement.
While we cannot comment on which parameter of exercise was most efficacious, we can conclude that
participation in regular, progressively challenging exercise can, in general, help to slow functional
decline in this vulnerable population.
CONCLUSION

With the burgeoning elderly population and expanding life expectancies, programs that can promote functional independence and minimize disability are taking on greater importance. Institutionalized settings such as assisted living facilities develop and implement wellness exercise programs to help their residents manage chronic disease, improve physical function, and enjoy a better quality of life. This study demonstrated that regular participation in a wellness exercise program could protect functional decline in older adults in assisted living complexes.

REFERENCES


